

## Basement structure beneath the innershelf off Mahabalipuram to Palar river, east coast of India

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Magnetic data along three coastal parallel profiles over the innershelf (30-50 m water depth) off Mahabalipuram recorded short wavelength and high amplitude (peak to peak of the order of 200-700 nT) anomalies. Two linear NW-SE trends were delineated from the coastal parallel profiles. Two dimensional modelling of the three sections ( $P_1$  to  $P_3$ ) indicate folded and faulted magnetic basement beneath the Mahabalipuram shelf. The amplitude of these folds is relatively more at shallow depths (30 m). The folded nature of the basement is still prevalent at greater depths (50-60 m) off Palar river whereas further north towards Mahabalipuram the basement appears to be smooth at greater depths. The results indicate that Palar river is associated with a faulted basement.

The northern part of eastern continental margin of India (ECMI) between Kakinada and Paradip is associated with intense high amplitude magnetic anomalies ( $> 1500$  nT) whereas the southern part between Kakinada and Nizampatnam is associated with subdued magnetic anomalies<sup>1-5</sup>. Magnetic anomaly map<sup>2</sup> indicates relatively high amplitude ( $\approx 200$  nT) magnetic anomalies over the Tamil Nadu margin between Madras and Palar river mouth. In the present study, magnetic data along three coast parallel profiles over the innershelf off Palar river mouth to Mahabalipuram were analyzed to study the nature of the magnetic basement beneath the shelf.

The data were collected on board the *RV Gaveshani* during its 231 cruise from 27 June to 17 July, 1992. Three profiles ( $P_1$  to  $P_3$ ) were located over the innershelf covering the water depths from 30-60 m (Fig. 1). Magnetic data were collected using a Barringer Proton Precession Magnetometer (Model M123). The sensor was towed nearly 150 m behind the vessel and total magnetic field was continuously recorded on analog chart recorder using a polarization interval of 30 sec. Total intensity magnetic data along these profiles were corrected for regional field International Geomagnetic Reference Field (IGRF) and the residuals were plotted.

Magnetic data along the three parallel profiles (Fig. 1) indicate short wavelength, high amplitude anomalies. Profile  $P_1$  following nearly the 30 m water depth shows intense magnetic anomalies with peak to peak amplitude of nearly 700 nT. The amplitude reduces towards deeper depths (50 m) as can be seen from profiles  $P_2$  and  $P_3$ . The trend of the anomalies suggests much higher amplitudes at depths below 30

m, where data could not be collected on research vessel. Magnetic data collected along vertical profiles in this region<sup>2</sup> also indicate high amplitude anomalies over this region with amplitudes of the order of 250 nT.

Two linear NW-SE trends (marked as A and B, Fig. 1) cutting across the coast could be inferred from the magnetic data along the parallel profiles  $P_1$  to  $P_3$ . Trend A is located off Palar river and is associated with relatively high amplitude (peak to peak 750 nT) anomalies, particularly at shallow depths (profile  $P_1$ , Fig. 2). Trend B is located between Palar river mouth and Mahabalipuram and is associated with relatively

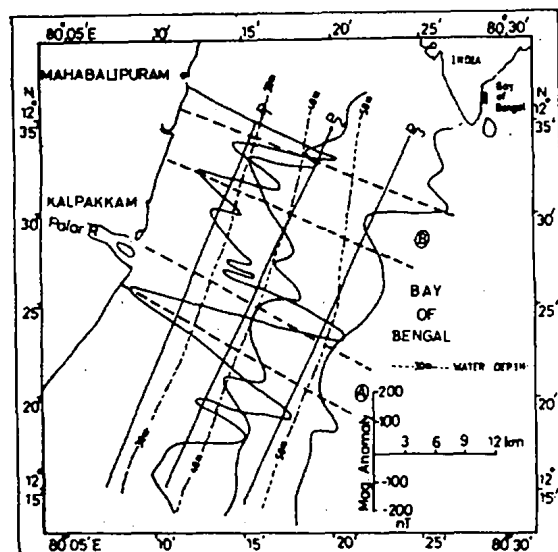


Fig. 1—Magnetic anomaly sections along the coast parallel profiles  $P_1$ ,  $P_2$  and  $P_3$

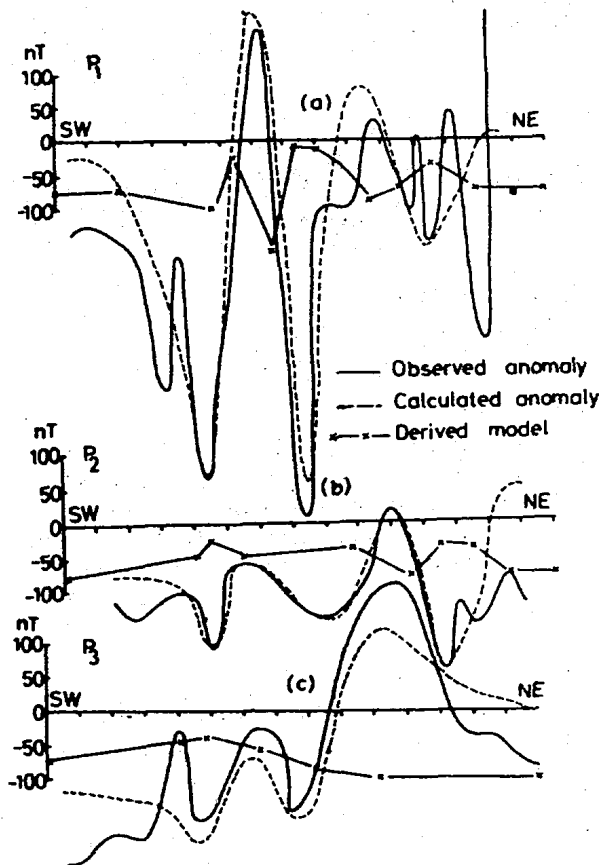


Fig. 2—Two dimensional modeling of the three coast parallel sections at  $P_1$ ,  $P_2$  and  $P_3$

less amplitude (500 nT) anomalies. The profile at deeper depth ( $P_3$ ) gives a clear indication of these two trends, though the amplitude here is much reduced (Fig. 1).

All the three anomaly sections ( $P_1$ ,  $P_2$  and  $P_3$ ) were subjected to two dimensional modelling using the interactive forward method of Talwani & Heirtzler<sup>6</sup>. The deduced basement configuration along these sections was plotted in Fig. 2. Model studies indicate a folded basement (anticlines and synclines), with the amplitudes of the folds more pronounced at shallow depths (profile  $P_1$ ). The average depth to the basement in the study area is of the order of 3 km and it reaches to nearly 1 km at places, particularly off Palar river (Fig. 2). Though the amplitude of the folds decreases at larger depths ( $P_2$  and  $P_3$ ), the folded nature still prevails particularly off Palar river (profile  $P_3$ ). Basement sloped towards Mahabalipuram (profile  $P_3$ ).

Basement section (Fig. 3) clearly reflects linear NW-SE trends A and B inferred from the magnetic anomalies (Fig. 1). Trend A off Palar river is associated with severely folded and probably faulted basement. In all probability, this trend appears to

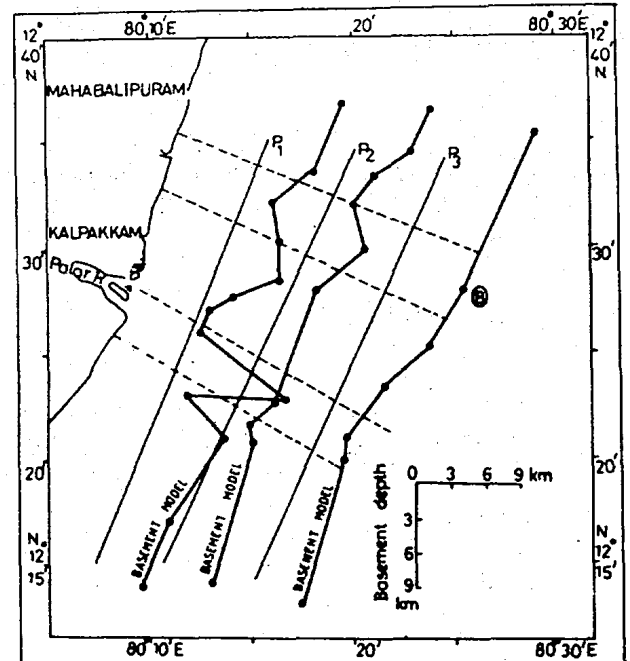


Fig. 3—Basement trends off Mahabalipuram shelf, deduced from the model studies

extend further landward, thereby indicating that Palar river is associated with a significant structural lineament in the basement. The linear trend B located south off Mahabalipuram also indicates a folded basement, though the amplitude of the folding along this trend appears to be relatively less in comparison to that off Palar river (Fig. 3). Depth section at deeper parts of the shelf (profile  $P_3$ , Fig. 3 for example) indicates that the basement is relatively at shallow depth off Palar in comparison to north of it.

The presence of coastal cross trends in the basement deduced from the present study and the earlier studies<sup>2</sup> which suggested linear NE-SW trends of dyke intrusions over the Madras-Pondicherry margin confirm that the basement structure beneath Madras-Mahabalipuram part of the eastern margin is highly complex.

#### References

- 1 Murthy K S R, Rao T C S & Malleswara Rao M M, *Indian J Mar Sci*, 16 (1987) 19.
- 2 Murthy K S R, Rao T C S, Subrahmanyam A S, Malleswara Rao M M & Lakshminarayana S, *Mar Geol*, 114 (1993) 171.
- 3 Rao T C S & Rao V B, *Mar Geol*, 67 (1985) 151.
- 4 Rao T C S, Murthy K S R, Malleswara Rao M M, Subrahmanyam A S, Lakshminarayana S, Mohana Rao K & Reddy N P C, Technical Report (TR-3/88) (National Institute of Oceanography, Goa, India) 1988.
- 5 Subrahmanyam A S, Murthy K S R, Rao T C S, Malleswara Rao M M, Lakshminarayana S & Venkateswarlu K, *Proc Indian Acad Sci*, 103 (1994) 17.
- 6 Talwani M & Heirtzler J R, in *Computers in mineral industry*, edited by G A Parks, (Stanford Univ Press, USA) 1964, 464.